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Effects of Southern Oscillation and North Sea-Caspian Pattern on the rainfall intensity series in the Black Sea Region of Türkiye

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Abstract— This study investigates the influence of the Southern Oscillation and North Sea-Caspian Pattern on maximum rainfall intensities in the Black Sea Region of Türkiye. Annual maximum rainfall intensity series from 16 meteorological stations were analyzed, and correlation coefficients were calculated and evaluated at $\alpha = 0.01, 0.05,$ and 0.10 significance levels. Results indicate that the Southern Oscillation predominantly affects short- and medium-duration rainfall in Sinop, whereas the North Sea-Caspian Pattern shows significant correlations with medium- and long-duration rainfall in Bartın, Bayburt, and Gümüşhane. These findings highlight the spatially varying influence of atmospheric oscillations on rainfall extremes in the region.

Key-words: Southern Oscillation, North Sea-Caspian Pattern, rainfall intensity; atmospheric oscillation; Türkiye

1. Introduction

Climate refers to the long-term average of atmospheric parameters observed in a specific region. It encompasses not only average conditions but also statistically significant variations, which distinguish climate from weather, defined as instantaneous atmospheric states. To characterize a region's climate, statistical analyses of at least 30-year records of variables such as temperature, precipitation,

wind direction and intensity, relative humidity, and sea level pressure are required. Climate change should be expressed as meaningful long-term variations rather than daily fluctuations, while extreme weather events may reflect or result from such changes (*Sen, 2019*). Recent attention to climate change stems from its wide-ranging effects on human life, socio-economic conditions, and environmental systems.

Hydrometeorology, which bridges hydrology and meteorology, plays a critical role in planning and managing water resources by assessing changes in precipitation, temperature, humidity, evaporation, and river flow, as well as their drivers. With ongoing global climate change, studies utilizing these hydrometeorological parameters have gained increasing importance, as they inform both resource management and disaster mitigation strategies.

The variability of climate parameters is partly influenced by local and global atmospheric circulations. Some circulation patterns exhibit periodic behaviors that can affect regions at large distances simultaneously. Such teleconnections, including the Southern Oscillation (SO) and the North Sea-Caspian Pattern (NCP), represent large-scale atmospheric interactions with significant hydrometeorological impacts (*Hurrell et al., 2003*). Numerous studies have investigated the influence of atmospheric oscillations on hydrometeorological variables. For example, temperature has been linked to SO and NCP phases (*Türkeş, 1990; Kutiel et al., 2002; Türkeş and Erlat, 2008; Iqbal et al., 2016; Sezen and Partal, 2019; Hassan and Al-Asadi, 2023*), precipitation has shown correlations with SO, North Atlantic Oscillation (NAO), and NCP (*Rodo et al., 1997; Ropelewski and Halpert, 1987; Kadioğlu et al., 1999; Chowdhury and Beechem, 2010; Givati and Rosenfeld, 2013; West et al., 2021; Hosseini et al., 2022*), and river flow has also been associated with these indices (*Cullen et al., 2002; Zhang et al., 2007; Karabork and Kahya, 2009; Tabari et al., 2014*).

Previous research has revealed that the SO affects precipitation patterns across the Pacific basin (*Ropelewski and Halpert, 1987*), while NAO and SO modulate seasonal precipitation in Southern Europe, particularly in autumn and winter (*Rodo et al., 1997*). *Halpert and Ropelewski (1992)* reported stronger SO-related temperature effects in tropical regions, excluding the Western Pacific. *Petriello (1999)* linked sea level pressure, temperature, and precipitation to NAO phases in Europe, America, and Africa, whereas *Hurrell and van Loon (1997)* demonstrated that decadal climate variability is influenced by NAO indices. Studies focusing on NCP have also shown region- and season-specific effects on temperature and precipitation (*Ghasemi and Khalili, 2008; Brunetti and Kutiel, 2011; del Rio et al., 2013; Nastos et al., 2011; Talaee et al., 2014*).

Türkiye's climate is influenced by both maritime and continental air masses, as well as low- and high-pressure systems, including Iceland, Siberia, Azores, and Basra lows (*Göktürk and Karaca, 2006*). Several atmospheric oscillations, such as NAO, Arctic Oscillation (AO), SO, and NCP, have been shown to significantly affect Türkiye's hydrometeorological variables (*Kahya and Karabörk, 2001*;

Türkeş and Erlat, 2003; Kalaycı et al., 2004; Göktürk, 2005; Karabörk et al., 2005, 2007; Kutiel and Türkeş, 2005; Kerimoğlu, 2008; Marti et al., 2010; Öztürk et al., 2011; Tosunoglu et al., 2018; Partal, 2018; Yarbaşı and Marti, 2019; Akkoyunlu et al., 2019; Yılmaz et al., 2020; Sezen and Partal, 2020; Demir and Koc, 2021; Kebapcioglu and Partal, 2022). In particular, ENSO events have been shown to alter precipitation regimes in southern Türkiye (*Kadıoğlu et al., 1999*), while NAO and SO influence river flows in central and eastern regions (*Cullen and deMenocal, 2000; Kahya and Karabork, 2001; Turkes and Erlat, 2003; Göktürk, 2005; Kutiel and Türkeş, 2005; Karabörk and Kahya, 2009; Bozyurt and Özdemir, 2017; Tosunoglu et al., 2018; Sezen and Partal, 2019*).

Despite extensive research on atmospheric oscillations and hydrometeorological variables, few studies have examined the relationship between extreme rainfall intensities and oscillation indices (*Lepore et al., 2016; Gehlot et al., 2021; Salameh et al., 2022; An et al., 2023; Ulke Keskin et al., 2024*). Therefore, this study focuses on evaluating the influence of SO and NCP on annual maximum rainfall intensities across the Black Sea Region of Türkiye. By analyzing these relationships, the study aims to contribute to the understanding of extreme precipitation events, which is critical for flood risk assessment, water resource planning, and regional climate adaptation strategies.

This paper is structured as follows: Section 1 provides the general background and motivation for this study, Section 2 introduces the atmospheric indices, Section 3 presents the data sources, Section 4 details the analysis methods, Section 5 evaluates the results, and Section 6 provides the conclusions.

2. Atmospheric indices

2.1. Southern Oscillation (SO)

The Southern Oscillation (SO) is a large-scale oscillation that expresses the exchange of atmospheric pressure between the western and eastern parts of the Pacific Ocean at tropical latitudes. SO is considered the most notable sign of interannual climatic changes. The extreme phases of this oscillation are known as El Niño and La Niña events. El Niño events correspond to higher-than-normal atmospheric pressure in the southeast Pacific. La Niña events, on the other hand, express the opposite conditions of El Niño events (*Karabork and Kahya, 2009; Tosunoglu, 2014; Tosunoglu et al., 2018*).

The Southern Oscillation Index (SOI) expresses the pressure difference between the western and eastern Pacific and is defined as the difference between the standardized sea level atmospheric pressure in Tahiti and the sea level atmospheric pressure in Darwin (Australia). SOI refers to the pressure difference between the eastern and western Pacific. When the SOI value, which is positive under normal conditions, drops to negative values, the atmospheric pressure in the eastern Pacific decreases and eastern trades weaken or blow from the west (*Kahya*

and *Dracup*, 1993; *Tosunoglu*, 2014; *Tosunoglu et al.*, 2018). For more details, please refer to *Ropelewski and Jones* (1987), *Allan et al.* (1991), and *Können et al.* (1998).

2.2. North Sea-Caspian Pattern (NCP)

The North Sea-Caspian Pattern by *Kutiel and Benaroch* (2002), one around the North Sea, the other around the Caspian Sea, is defined as the large-scale atmospheric pressure fluctuation between two regions (*Kutiel and Benaroch*, 2002). *Kutiel and Benaroch* (2002) revealed the North Sea-Caspian Pattern Index (NCPI). They used this index to indicate the magnitude of the North Sea-Caspian Pattern. When the NCPI is in the positive phase, the negative pressure in the center of the Caspian Sea causes a counterclockwise movement, whereas the pressure in the center of the North Sea causes a clockwise movement. As a result of these two movements, the cold and dry air mass affects the Eastern Mediterranean region from Russia. When the NCPI is in the negative phase, a hot and rainy weather occurs, unlike the situation in the positive phase, and the effect of this air mass is seen in the regions from the South to the Mediterranean. The North Sea-Caspian Pattern generally shows its effect in autumn, winter, and spring, while in summer, its effect is less than the effects of the others (*Tosunoglu*, 2014; *Tosunoglu et al.*, 2018). For more details, please refer to *van Kutiel and Benaroch* (2002), *Kutiel et al.* (2002) and *Kutiel and Turkes* (2005).

3. Materials

The Black Sea Region of Türkiye, which receives the highest annual precipitation in the country, plays a critical role in human activities and water resources (*Yilmaz et al.*, 2020). The eastern part of the region experiences particularly heavy rainfall (*Gürgen*, 2004). Geographically, the region is located between 40°–42° N latitude and 30°–42.5° E longitude, covering approximately 135000 km², about 18% of Türkiye's total area.

The North Anatolian Mountains, extending parallel to the coast, largely determine the region's topography and climate. Kaçkar Peak, the highest point at 3932 m, is located in the eastern part. Mountain slopes create differences in climate between coastal and inland areas: coastal zones are humid with moderated temperatures due to the sea, whereas inland areas experience lower humidity and greater temperature variation. However, the central part of the Black Sea region allows partial penetration of the sea effect due to relatively lower altitudes (*Turak et al.*, 2011).

Annual maximum rainfall intensity series (mm/min) for 14 standard durations—5', 10', 15', 30', 60', 120', 180', 240', 300', 360', 480', 720', 1080', and 1440'—were recorded at 16 meteorological stations operated by the Turkish State Meteorological Service (TSMS) in the Black Sea Region. For classification

purposes, 5–30-minute rainfalls are considered short-term, 60–360-minute rainfalls medium-term, and 480–1440-minute rainfalls long-term (Karahan, 2011, 2019; Zeybekoglu and Karahan, 2018). Table 1 lists the stations, their coordinates, altitude, and record periods, while Figure 1 shows their geographical distribution.

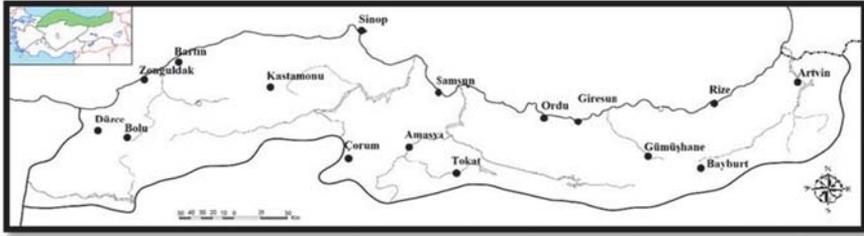


Fig. 1. Spatial distribution of meteorological stations throughout Black Sea Region Türkiye

Table 1. Meteorological observation stations and their records periods in the Black Sea Region

Station Name	Record period	Altitude (m)	Longitude (N)	Latitude (E)
Amasya	1965-2015	40	40.667	35.835
Çorum	1958-2015	776	40.546	34.936
Ordu	1965-2015	5	40.984	37.886
Samsun	1957-2015	4	41.344	36.255
Sinop	1965-2015	32	42.03	35.155
Tokat	1966-2015	611	40.331	36.558
Artvin	1965-2015	613	41.175	41.819
Bolu	1949-2015	743	40.733	31.602
Kastamonu	1948-2015	800	41.371	33.776
Rize	1940-2015	3	41.040	40.501
Düzce	1965-2015	146	40.844	31.149
Giresun	1966-2015	38	40.923	38.388
Bartın	1966-2015	33	41.625	32.357
Bayburt	1966-2015	1584	40.255	40.221
Gümüşhane	1966-2015	1216	40.460	39.465
Zonguldak	1945-2015	135	41.449	31.778

4. Methodology

In this study, the Pearson correlation coefficients were calculated to distinguish between the atmospheric oscillation index and the rainfall intensity (*Bayazit and Oğuz, 2005*):

$$r_{X,Y} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{NS_X S_Y} \quad (1)$$

where x_i is the value of the rainfall intensity in the i th year of the timeseries, \bar{x} is the average of rainfall intensity, y_i is the i th value of the atmospheric oscillation index (AOI), \bar{y} is the average of AOI, N represents the number of data, S_X is the standard deviation value of the rainfall intensity, and S_Y is the standard deviation of the atmospheric oscillation index data.

After obtaining the correlation coefficients the significance levels of $\alpha = 0.01$, $\alpha = 0.05$ and $\alpha = 0.1$ were evaluated by using Student's t-test. The correlation breakpoints were obtained with the distribution (*Bayazit and Oğuz, 2005*):

$$t = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}, \quad (2)$$

where t represents the test statistic, r represents the correlation value, and N represents the number of data.

5. Results of the relationship between rainfall intensities and atmospheric indices

The correlation coefficients between rainfall intensities and the SO and the NCP indices at the 16 meteorological stations in the Black Sea Region are presented in *Tables 2* and *3*. For each standard duration, correlations were tested for significance at $\alpha = 0.01$, 0.05 , and 0.1 using the Student's t-test. Significant correlations are illustrated in *Figures 2* and *3*, where upward triangles indicate positive correlations and downward triangles indicate negative correlations, with red, blue, and green corresponding to $\alpha = 0.01$, 0.05 , and 0.1 , respectively. Non-significant correlations are not displayed.

Table 2. Correlation coefficients between SO and rainfall intensities (5' indicates 5-minute rainfall, and so forth)

Station	5'	10'	15'	30'	60'	120'	180'	240'	300'	360'	480'	720'	1080'	1440'
Amasya	-0.11	-0.14	-0.10	-0.05	-0.03	0.00	0.05	0.12	0.15	0.17	0.19	0.22	0.17	0.16
Çorum	-0.13	-0.05	-0.03	0.03	0.06	0.11	0.10	0.08	0.08	0.07	0.06	0.07	0.05	0.06
Ordu	0.09	0.20	0.11	0.15	0.09	0.07	0.11	0.13	0.17	0.21	0.18	0.16	0.18	0.16
Samsun	-0.02	0.03	0.03	0.06	0.01	0.03	0.04	0.03	0.04	0.04	0.06	0.09	0.07	0.05
Sinop	0.35	0.36	0.33	0.30	0.23	0.22	0.22	0.27	0.27	0.27	0.26	0.28	0.22	0.12
Tokat	-0.16	-0.16	-0.15	-0.11	-0.12	-0.09	-0.08	-0.05	-0.04	-0.02	-0.04	-0.04	0.07	0.19
Artvin	0.16	0.23	0.25	0.23	0.21	0.20	0.19	0.19	0.20	0.21	0.19	0.20	0.20	0.28
Bolu	0.03	0.03	0.03	0.06	0.05	0.06	0.06	0.04	0.04	0.03	0.01	0.01	0.02	-0.05
Kastamonu	0.01	-0.03	-0.01	0.00	-0.02	-0.03	-0.03	-0.02	-0.01	0.01	0.01	0.01	0.04	-0.07
Rize	-0.03	-0.06	-0.05	-0.14	-0.20	-0.22	-0.19	-0.15	-0.10	-0.07	-0.08	-0.07	-0.06	-0.08
Düzce	-0.07	-0.03	-0.04	-0.07	-0.07	-0.06	-0.04	-0.03	-0.03	-0.01	-0.01	0.01	0.04	0.09
Giresun	0.06	0.04	0.04	0.01	0.03	0.06	0.05	0.05	0.05	0.06	0.04	0.03	0.00	0.03
Bartın	0.01	0.02	0.04	-0.05	-0.03	-0.04	-0.02	0.03	0.03	0.04	0.10	0.11	0.07	0.09
Bayburt	0.00	-0.02	-0.01	-0.02	-0.04	-0.11	-0.16	-0.19	-0.20	-0.21	-0.24	-0.25	-0.22	-0.22
Gümüşhane	-0.08	-0.09	-0.07	-0.06	-0.07	-0.09	-0.10	-0.10	-0.09	-0.09	-0.11	-0.11	-0.12	-0.03
Zonguldak	0.11	0.10	0.10	0.09	0.06	0.05	0.04	0.05	0.06	0.07	0.06	0.06	0.06	0.07

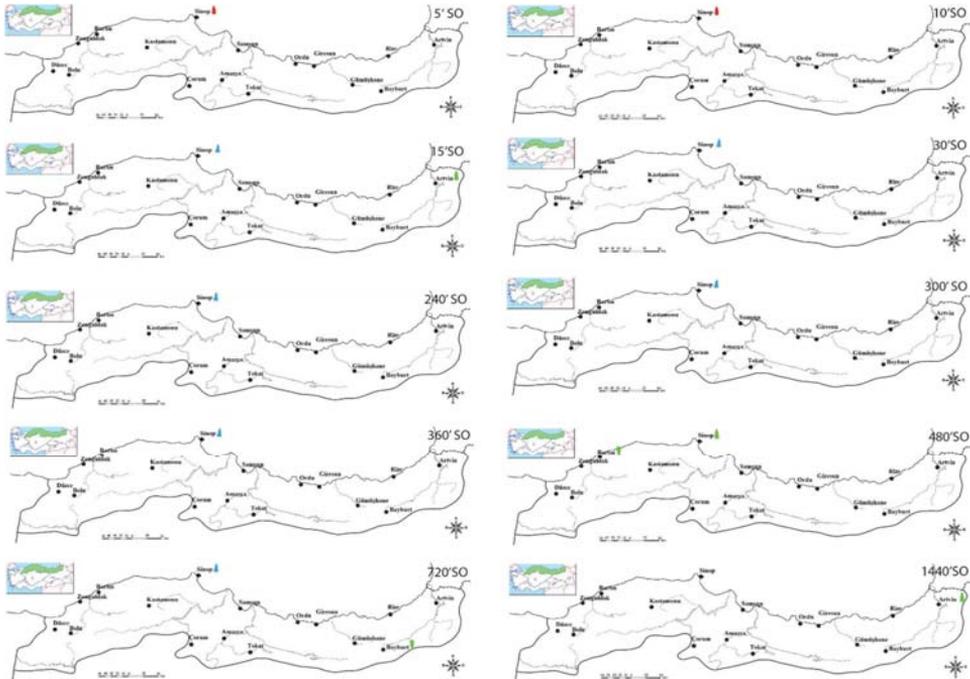


Fig. 2. Spatial distribution of correlation between SO and rainfall intensity series of 14 standard durations in the Black Sea Region Türkiye.

According to *Table 2* and *Fig. 2*, significant correlations between rainfall intensities and SO were predominantly observed at Sinop, indicating that higher SO index values generally lead to increased rainfall. Short-term rainfalls (5–30 minutes) displayed positive correlations at $\alpha = 0.01$ for 5' and 10', and at $\alpha = 0.05$ for 15' and 30'. For medium-term rainfalls (60–360 minutes), significant positive correlations were found at $\alpha = 0.05$ for 240', 300', and 360', and at $\alpha = 0.1$ for 60' and 480'. Long-term rainfalls (480–1440 minutes) showed significant correlations at $\alpha = 0.05$ for 720', and at $\alpha = 0.1$ for 360', 480', and 1440'.

Other stations also showed occasional significant correlations. Artvin had positive correlations at $\alpha = 0.1$ for 15' and 1440' durations, while Bayburt showed a negative correlation at $\alpha = 0.1$ for 720'. No significant correlations were observed for 120' and 180' rainfalls across most stations. These results suggest that the influence of SO is highly localized, with Sinop showing the most consistent response across multiple rainfall durations. Short-duration rainfalls tend to be more consistently affected, whereas medium- and long-duration rainfalls show sporadic correlations in other stations, likely due to local topography and regional climatic conditions.

Table 3. Correlation coefficients between NCP and rainfall intensities (5' indicates 5-minute rainfall, and so forth)

Station	5'	10'	15'	30'	60'	120'	180'	240'	300'	360'	480'	720'	1080'	1440'
Amasya	0.00	-0.02	-0.01	0.06	0.10	0.09	0.08	0.07	0.08	0.10	0.12	0.08	0.03	-0.03
Çorum	-0.11	-0.07	-0.08	-0.02	0.00	0.02	0.06	0.07	0.08	0.08	0.09	0.06	0.04	-0.05
Ordu	0.05	0.09	0.14	0.10	0.16	0.09	0.09	0.07	0.08	0.09	0.08	0.08	0.12	0.19
Samsun	0.14	0.14	0.03	0.02	0.01	-0.02	-0.04	-0.04	-0.03	-0.06	-0.02	0.00	-0.01	0.00
Sinop	0.00	-0.01	-0.02	-0.01	0.01	-0.06	-0.09	-0.10	-0.11	-0.12	-0.16	-0.20	-0.16	-0.13
Tokat	0.06	0.14	0.11	0.10	0.13	0.11	0.13	0.12	0.11	0.06	0.10	0.10	-0.08	-0.28
Artvin	0.15	0.24	0.19	0.08	-0.01	-0.09	-0.12	-0.10	-0.05	0.04	0.12	0.15	0.17	0.33
Bolu	0.00	0.03	0.06	0.10	0.07	0.07	0.11	0.12	0.14	0.18	0.19	0.27	0.20	0.12
Kastamonu	0.06	0.12	0.16	0.14	0.10	0.06	0.05	0.04	0.07	0.08	0.07	0.01	-0.01	0.04
Rize	-0.10	-0.16	-0.12	-0.13	-0.23	-0.20	-0.17	-0.13	-0.11	-0.14	-0.15	-0.18	-0.18	-0.21
Düzce	0.02	0.12	0.13	0.09	0.10	0.07	0.06	0.04	-0.04	-0.07	-0.09	-0.08	-0.01	0.02
Giresun	-0.20	-0.20	-0.20	-0.14	-0.07	-0.02	-0.06	-0.09	-0.11	-0.11	-0.15	-0.16	-0.11	-0.09
Bartın	0.03	0.06	0.10	-0.14	-0.08	-0.10	-0.05	0.08	0.08	0.12	0.28	0.30	0.20	0.26
Bayburt	0.00	-0.05	-0.04	-0.04	-0.11	-0.31	-0.45	-0.51	-0.55	-0.57	-0.65	-0.68	-0.60	-0.60
Gümüşhane	-0.21	-0.25	-0.20	-0.15	-0.18	-0.24	-0.28	-0.28	-0.25	-0.25	-0.29	-0.29	-0.33	-0.08
Zonguldak	0.21	0.20	0.21	0.18	0.12	0.10	0.08	0.10	0.13	0.14	0.12	0.12	0.11	0.15

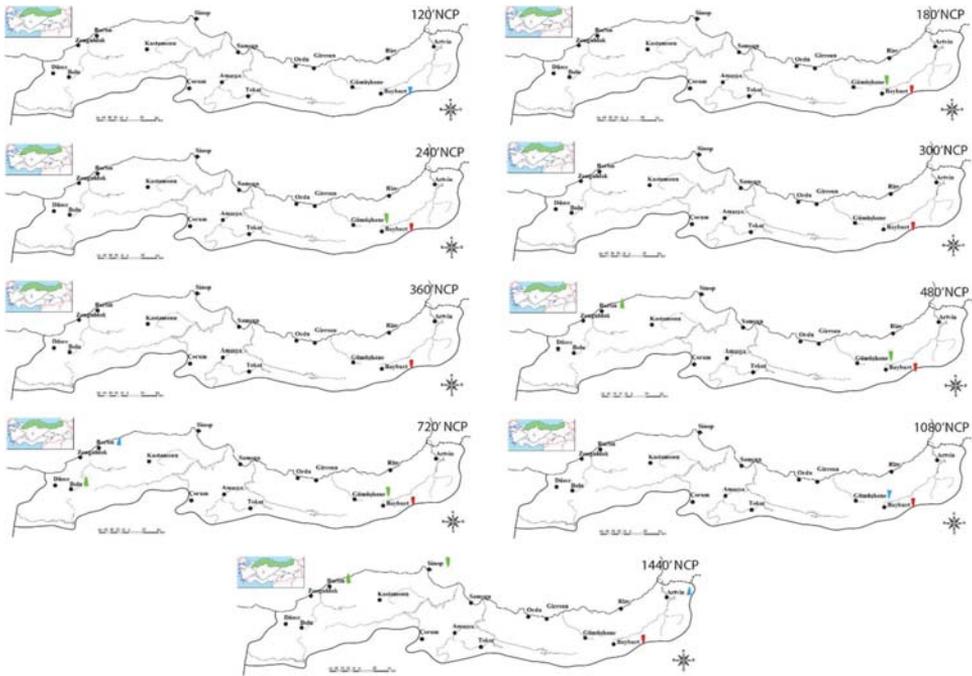


Fig. 3. Spatial distribution of correlation between NCP and rainfall intensity series of 14 standard durations in the Black Sea Region of Türkiye.

According to *Table 3* and *Fig. 3*, Significant correlations with NCP were mainly observed at Bartın, Gümüşhane, and Bayburt, predominantly affecting medium- and long-term rainfall durations. Short-duration rainfalls (5–60 minutes) did not show significant correlations. For medium-term rainfalls: 120' rainfall showed negative correlation in Bayburt ($\alpha = 0.05$); 180' rainfalls had negative correlations in Gümüşhane ($\alpha = 0.1$) and Bayburt ($\alpha = 0.01$); 240' rainfalls were negatively correlated in Gümüşhane ($\alpha = 0.1$) and Bayburt ($\alpha = 0.01$); 300' and 360' rainfalls were negatively correlated in Bayburt at $\alpha = 0.01$.

Long-term rainfalls also displayed station-specific correlations. At 480', positive correlation was observed in Bartın ($\alpha = 0.1$), negative in Gümüşhane ($\alpha = 0.1$) and Bayburt ($\alpha = 0.01$). For 720' rainfalls, Bartın showed positive correlation ($\alpha = 0.05$), Bayburt negative ($\alpha = 0.01$), and Gümüşhane positive at $\alpha = 0.1$. At 1080', a negative correlation was found in Gümüşhane ($\alpha = 0.05$). For 1440', negative correlations were observed in Bayburt ($\alpha = 0.01$) and Artvin ($\alpha = 0.05$), while Tokat and Bartın showed negative and positive correlations, respectively, at $\alpha = 0.1$.

These patterns indicate that NCP predominantly influences medium- and long-duration rainfalls, with positive correlations in Bartın and negative

correlations in Bayburt and Gümüşhane. The differences in sign and significance across stations highlight the spatial variability of NCP effects, likely modulated by elevation, topography, and distance from the coast.

6. Discussion and conclusion

This study examined the effects of atmospheric oscillations on rainfall intensities in the Black Sea Region of Türkiye, focusing on the SO and the NCP indices. The analysis of 16 meteorological stations revealed that SO primarily affects Sinop, while NCP shows significant correlations in Bartın, Bayburt, and Gümüşhane. These findings are consistent with previous studies demonstrating that Türkiye's hydrometeorological parameters are sensitive to large-scale atmospheric oscillations (*Turkes and Ertlat, 2003; Karabork and Kahya, 2003, 2009; Kutiel and Turkes, 2005; Tosunoglu et al., 2018; Sezen and Partal, 2019, 2020*).

The results indicate that SO generally intensifies rainfall in Sinop across short-, medium-, and some long-term durations, whereas its effect on other stations is limited or absent. This aligns with previous findings suggesting that the impact of SO on precipitation is often highly localized and influenced by local topography and coastal effects (*Kahya and Karabork, 2001; Karabork and Kahya, 2009; Çakıroglu et al., 2017*). On the other hand, NCP predominantly affects medium- and long-duration rainfall in the eastern and northern parts of the region, with positive correlations in Bartın and negative correlations in Bayburt and Gümüşhane, reflecting the spatial heterogeneity of NCP influence. This is consistent with earlier studies showing that NCP impacts temperature and precipitation patterns differently across regions due to elevation, proximity to the coast, and local climatological conditions (*Kutiel and Turkes, 2005; Göktürk, 2005; Çakıroglu et al., 2017; Tosunoglu et al., 2018*).

These findings have important implications for hydrometeorology and water resource management in the Black Sea Region. Understanding the relationships between atmospheric oscillations and rainfall intensities can contribute to better planning for flood risk, water supply, and disaster management. For instance, stations showing consistent positive correlations with SO or NCP may experience intensified precipitation under certain atmospheric conditions, which could increase the risk of floods or landslides. Incorporating these indices into predictive models could improve the forecasting of extreme rainfall events and support proactive measures in local disaster preparedness strategies (*Celik et al., 2020; Gunduz, 2022; Usta, 2023*).

This study also highlights the need for further regional analyses across Türkiye. By extending similar investigations to other geographic regions, researchers can better understand the spatial variability of atmospheric oscillation effects and their contributions to climate change and extreme weather events.

Moreover, evaluating rainfall intensity along with other hydrometeorological variables, such as temperature, humidity, and flow, may provide a more comprehensive understanding of regional climate dynamics.

In conclusion, the study demonstrates that atmospheric oscillations play a significant and duration-dependent role in shaping rainfall intensities in the Black Sea Region. SO primarily affects short- and medium-duration rainfalls in Sinop, while NCP influences medium- and long-duration rainfalls in Bartın, Bayburt, and Gümüşhane, with both positive and negative correlations depending on the station. These insights are valuable for climate-related risk assessment, water resource management, and disaster mitigation strategies, and contribute to the national and international literature by focusing on rainfall intensity, which is a critical parameter for understanding extreme hydrological events.

Data availability: Rainfall data provided by the Turkish State Meteorological Service (TSMS) can be purchased from <https://mevbis.mgm.gov.tr/mevbis/ui/index.html#/Workspace>, (Purchase number: 20171010D771).

Author contributions: AUK: investigation, methodology, supervision, validation and writing (original draft, review and editing). RK: investigation, methodology, formal analysis and writing (original draft, review and editing). UZ: data curation, investigation, methodology, formal analysis, validation, visualization, supervision and writing (original draft, review and editing).

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